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ON WAYS OF IMPROVING THE METHODS OF PROCESSING SIGNALS FROM THE A-22-III RADIOSONDE

-USSR-

By R. O. Tydel'skiy

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/Following is the translation of an article by R. O. Tydel'skaya entitled "O Putyakh Usovershenstvovaniya Metodiki Obrabotki Signalov Radiozonda A-22-III" (English version above) in Meteorologiya i Gidrologiya (Meteorology and Hydrology), No 9, 1960, Moscow, pages 35-38./

In 1958 new radiosonde models, A-22-III, were placed in service at a number of points in SSR Aerological network. Details of construction of this device and the principle by which it records its signals, were covered in a special article (2).

A very important question, confronting the aerologists is how to standardize the methods of processing the recordings of signals from the A-22-III in order to expedite and simplify the time-consuming part of the aerological computations. In the present article are reviewed certain proposals in this area by the aerological network staff members which were submitted to the Central Aerological Observatory.

During 1959 eight proposals were submitted. Four of them, (S. A. Budarina, UGMS /Uprovleniye gidrometeorologich eskoy sluzhby -- Hydrometeorological Service Administration/ Uzbek SSR, G. A. Vesnitskiy, Verkhne-Volzhskoye UGMS, N. M. Akimova, UGMS of the Ukrainian SSR and . S. Ochkovskiy, UGMS of the Latvian SSR), can be placed in a single group since they are all concerned with the construction of calibration curves on special template plotters made of plastic or celluloid or on a semi-automatic recorder receiving tape recording signals from the A-22-III radiosonde.

S. A. Budorina proposes the printing of blank charts on transparent paper to the scale of the receiving tape and pending the printing of these forms, the utilization of a special ruler made of transparent material and measuring 300mm by 400mm.

A grid of mutually perpendicular lines spaced so that a distance between lines is equal to the width of one receiving tape is graduated on this ruler. 100 graduations are made horizontally, each tenth graduation is numbered, vertically a larger number of lines is possible with marks for temperature on the scale of 1 degree to 5 squares and relative humidity with 1 percent equalling 1 square (pressure calculated as usual).

Prior to the release of the radiosonde a given verification curve of temperature and humidity is transferred in ink from the chart to the

ruler (in linear sections). Let us note that the verification curve of humidity on the recorder drum occupies only one section, but the temperature curve has three sections and may have several cut-offs. Variations are marked on the ruler margins in the form of base lines. Calculations are accomplished by means of moving the ruler until the graduations on the ruler coincide with those of the receiving tape. The verifications of meteorological elements are read at the points of intersection of curves and synchronized lines on the receiving tape, (corresponding to standard pressure readings, special points and standard heights) with the appropriate verification curves on the ruler.

G. A. Vesnitskiy proposed utilization of two special transparent rulers, main and auxiliary, size 350-400x50x2 mm.

On the main ruler (Fig. 1a) the lines are graduated into tens and four horigontal lines 10mm apart. They are marked with the apparent temperature and humidity along their graduations, taken from the verification charts. Graduations are marked on the reverse side of the ruler; the face part is sanded with emery cloth so that it is possible to write on it. Prior to the release of the radiosonde, numbers of graduations are taken from the control curves of temperature and humidity for apparent temperature through 10° and moisture through 10%. In obtaining the value of the graduations a variation is introduced (taking in consideration its sign) and it is penciled on the ruler. Intervals of 10° or 10% of the humidity are divided into ten equal parts with the aid of the dividing triangle (Fig. 1b). Further processing is carried out by a method analogous to that proposed by Budarina.

The auxiliary ruler (Fig. 1b) which has three scales and a nomogram is designed for expediting performance of certain operations in calculating signals from the radiosonde A-22-III.

Section 1, marked to scale, has two graduations of 0-100mm; it is designed for marking points of height from the graph of the receiving tape. Section 2 serves for determination of the vertical velocity of the radiosonde. Placing this ruler with section 1 to the altitude line of the receiving tape so that point A coincides with the point of intersection of the height curve of any synchronized line (on the corresponding section of altitude curve) it is possible to find the vertical speed of the radiosonde (on section 2) along the synchronized line from point A.

Section 3 serves for marking apparent pressures on receiving tape. The author proposes construction of a pressure graph directly on receiving tape to scale with one graduation equal to 2 millibars.

Nomogram 4 serves to determine the altitude of layer centers for wind data processing. Such a nomogram was proposed in the beginning of 1959.

The method of A. S. Ochkovskiy appears to be somewhat different from that of Vesnitskiy. Ochkovskiy recommends transfer of (the temperature and humidity) verification curve directly drom curve charts onto the receiving tape, with variation already introduced. For this, before the release of the Radiosonde, verification curves are taken from apparent graduations through each 10° of temperature and 10% of humidity. In addition, for the temperature, apparent graduations are taken for the beginning and the end of each new section. Variations are introduced into the obtained apparent

A- Date
B- Time

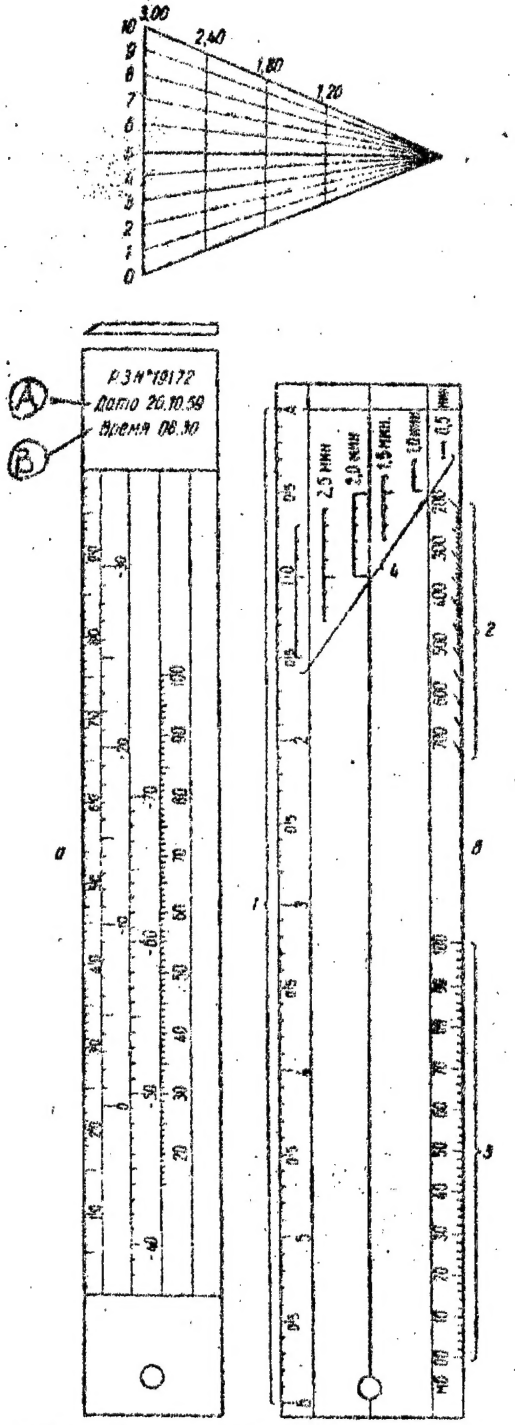

Fig. 1. Ruler for calculation of results of probes A-22-III radiosonde.

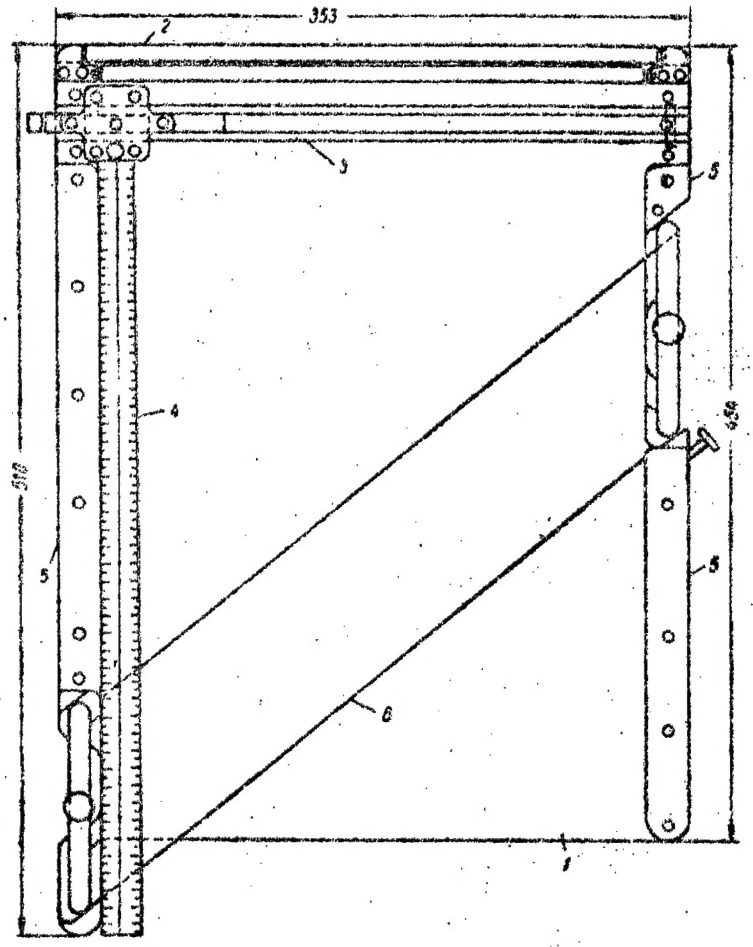

Fig. 2. Plotter for calculation of results of probes with radiosonde A-22-III. 1) Base of plotter. 2) Roller. 3) Direction ruler. 4) Sliding arm. 6) Margins. 6) Template.

graduations. After the release of the radiosonde, as the tape unwinds traces of verifications are entered on a scale of 2cm = 2° and 2cm = 2%.

Further processing is carried out as usual, but apparent temperature and humidity for special points and standard heights, as well as humidity for altitudes corresponding to standard pressure readings are recommended to be entered in Table TAE-3.

N. M. Akimov proposes utilization of a plotter with outside dimensions of 700 by 350mm with transparent template measuring 305 by 300 by 1mm.

Prior to the release of radiosonde on its flight, verification curves for temperature and humidity are plotted on a verification chart and traces of the chart are plotted with ink (with variations taken into account). For temperature, two or three parallel cut off curves are marked off, for humidity, one curve. Without removing the template from the curve of the chart, the curves on it are broken down by temperature through 1 ° and humidity through 5%, and are correspondingly numbered through 2° and 10%.

The receiving tape is placed between the margins of the plotters and a template which can slide freely between the margins is placed on top. The calculations of radiosonde signals are then made in the manner proposed by Budarina and Vesnitskiy.

Now let us examine the methods of R. O. Tydel'skaya and P. L. Efimov (TSAO - Tsentral'naya Aerologicheskaya Observatoriya, Central Aerological Observatory).

These authors proposed that the processing results be recorded on the receiving tape. On the left side of the tape, on synchronized lines corresponding to standard pressure readings, must be recorded pressure, number of scales and true temperature and humidity; also given are data for the determination of standard pressure altitudes. On the right side of the tape are plotted apparent heights and the numbers of scales of temperature and humidity corresponding to special points (true temperature and humidity readings must be recorded directly in Table TAE-3 to save processing time and to avoid transcription errors). Altitude readings and numbers of scales of temperature and humidity for standard altitude are written in the middle part of the receiving tape (true temperature and humidity readings should also be entered at once in Table TAE-3). To simplify work on the verification curves of temperature and humidity prior to the release of the radiosonde, parallel curves are constructed and allowance is made for variation. Data on control check of the pressure recorder, maintenance check, maintenance prior to release of radiosonde and all other essential characteristics are recommended to be written on the reverse side of the blank form (on a special stamp). In this manner the need for Table TAE-4 is obviated.

For processing radiosonde signals from the A-22-III it is possible to use a plotter (R. O. Tydel'skaya and T. M. Kulinchenko) which eliminates the need for preliminary computations and intermediate operations (Fig. 2).

It is essential that in the checking offices of factories, the verification curves be constructed separately for all three elements (pressure, temperature and humidity) on the scale of the receiving tape. Pressure and temperature on verification graphs must be shown by three curves in one

section. The templates of verification curves for all three meteorological elements which are to be measured are added to the plotter.

While supporting the radiosonde in the air (prior to the releasing of the apparatus) the variations of temperature and humidity are determined in the usual manner. The pressure variation is taken from the control verification. Verification curves with calculated variations are placed into the template.

As the receiving tape unwinds during the reception of radiosonde signals it is placed between the margins of the frame 5 (Fig. 2).

Pressure, temperature and humidity are curves constructed on the receiving tape and template 6 is placed into the cradle of the frame with the pressure verification chart. Then the movable ruler 4 is brought in turn to coincide with the standard pressure reading (900, 850, 800 millibars etc.) on the form and at a point of intersection of the pressure curve on the receiving tape a dot is marked with the ruler and circled; the corresponding figure 900, 850 millibars etc. is marked, and then synchro lines are plotted in. At the same time separate marks on the temperature and humidity curves can be made. Templates with verification curves of temperature and humidity are marked in a similar manner; ruler 4 is moved to the needed point of the temperature or humidity curve on the receiving tape and at the intersection of the ruler and the curve on the form the true temperature or humidity are marked off.

The proposal of S. A. Porchkhidza (TSAO) refines the method of processing radiosonde signals in the following manner:

Having the recordings of pressure on the receiving tape of radiosonde A-22-III in the form of a curve, the calculation of the altitudes of special points can be made in the same manner as calculations of temperature and humidity for these points. Copying the scale numbers on the receiving tape and as usual introducing variation, pressure is found on the verification curve, and the altitude of the radiosonde is calculated.

To expedite calculations, the author computed special tables. They are constructed on the principle of altitudes differences, corresponding to apparent separate points and the altitudes of the adjacent standard pressures reading points. Introducing temperature correction for thickness of a layer, it is easy to find the height of a given point.

It is to be hoped that further active participation of aerological specialists may uncover more suitable means which will help to save time in processing radiosonde signals and so expedite the transmission of telegrams to forecasting agencies furnishing temperature and wind data obtained by radiosonde techniques.

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